What is claimed is:

1. A system for monitoring at least one parameter of interest relating to a pipeline having a fluid flow therein, comprising:

   a. at least one measurement station coupled to said pipeline for taking at least one measurement relating to the at least one parameter of interest; and

   b. a flow propelled interrogation device adapted to move proximate said at least one measurement station, said interrogation device further adapted to transmit a first signal to said at least one measurement station and to receive a second signal from the at least one measurement station relating to the parameter of interest.

2. The system of claim 1, wherein the flow propelled interrogation device comprises:

   i. a plurality of wheel assemblies mounted on at least one housing, said wheel assemblies extendable to contact an inner wall of said pipeline; and

   ii. a sail engaged with said at least one housing for intercepting at least a portion of said fluid flow for propelling said interrogation device along said pipeline.

3. The system of claim 2, further comprising a controller for controlling the motion of said interrogation device and for transmitting signals to and receiving signals from said at least one measurement station.

4. The system of claim 3, further comprising a power source supplying power to said controller.

5. The system of claim 3, wherein at least one of said plurality of wheel assemblies includes a brake acting cooperatively with said controller to control the speed of said interrogation device in the pipeline.

6. The system of claim 2, wherein the at least one housing includes a plurality of housings pivotally joined together to provide enhanced motion through at least one bend in said pipeline.

7. The system of claim 2, wherein the sail is adjustable in size.

8. The system of claim 7, wherein the controller adjusts the size of the sail according to programmed instructions to adjust the speed of the interrogation device in the pipeline.

9. The system of claim 1 wherein said at least one measurement station includes a sensor for making a measurement and a memory for storing data relating thereto.

10. The system of claim 1 wherein the at least one measurement station includes a power source for supplying power to the measurement station.

11. The system of claim 1 wherein the at least one measurement station is adapted to transmit data relating to the at least one parameter of interest upon receipt of a command signal.

12. The system of claim 1 wherein:

i. the interrogation device sends a command signal to the at least one measurement station; and

ii. the at least one measurement station transmits data upon receipt of the command signal.

13. The system of claim 1 wherein the at least one measurement station comprises a plurality of measurement stations disposed spaced apart along a length of the flow conduit.

14. The system of claim 1 wherein each of the at least one measurement stations includes sensors that provide measurements of at least two different parameters of interest.

15. The system of claim 1 wherein the at least one parameter of interest is selected from a group consisting of (i) corrosion, (ii) pressure, (iii) temperature, (iv) fluid flow state, (v) vibration, (vi) chemical composition,(vii) mechanical strain, (viii) chemical contamination, (ix) radioactive contamination, (x) biological contamination, (xi) inclination of said pipeline, and (xii) seismic events.

16. The system according to claim 1, wherein the at least one measurement station receives power from said interrogation device through a radio frequency transmission.

17. The system of claim 1 wherein the first signal and the second signal are radio frequency signals.

18. The system of claim 1 wherein the at least one measurement station includes interface circuitry and a processor acting according to programmed instructions.

19. The system of claim 17 wherein the at least one measurement station receives electrical power from said first signal.

20. The system of claim 1 wherein the at least one measurement station includes a real-time clock for time stamping a measurement event.

21. The system of claim 20 wherein said measurement event includes a measurement matching a predetermined criterion.

22. The system of claim 1 wherein the pipeline is made from a metallic material.

23. The system of claim 1, wherein the pipeline is made from a composite material.

24. The system of claim 1, wherein the pipeline is made from a cementitious material.

25. The system of claim 1, wherein the at least one measurement station is embedded in a flow conduit made of a composite material.

26. The system of claim 23, wherein the flow conduit made of a composite material includes at least one electrical conductor embedded along the length of said flow conduit, said electrical conductor adapted to act as an RF antenna for transmitting and receiving RF signals.

27. The system of claim 1, wherein the at least one measurement station receives power from a power source chosen from the group consisting of (i) a commercially packaged battery, (ii) a thick film battery integrally attached to the at least one measurement station, (iii) a piezoelectric power source deriving power from shock and vibration in the proximity of the measurement station, and (iv) a thermoelectric generator integrated into the measurement station.

28. The system of claim 1, wherein the fluid flow is a gas flow.

29. The system of claim 3, wherein the controller comprises :

i. circuits for controlling the brake actuation and the sail size;

ii. a processor and memory for performing predetermined instructions; and

iii. an RF transceiver for transmitting and receiving said first and second signals.

30. The system of claim 4, wherein the power source comprises a turbine-generator disposed on said housing and adapted to intercept a portion of said fluid flow for deriving power therefrom.

31. The system of claim 4, wherein the power source comprises at least one battery.

32. A method for monitoring at least one parameter of interest relating to a pipeline having a fluid flow therein, comprising;

a) coupling at least one measurement station to said pipeline at a predetermined location, said measurement station adapted to measure said at least one parameter of interest;

b) passing a flow propelled interrogation device proximate said at least one measurement station;

c) transmitting a first signal from said interrogation device to said measurement station, said measurement station measuring said at least one parameter of interest in response thereto; and

d) receiving at said interrogation device a second signal related to said parameter of interest transmitted by said measurement station.

33. The method of claim 32 wherein the first signal and the second signal are radio frequency signals.

34. The method of claim 32, wherein the at least one measurement station receives power from said first signal.

35. The method of claim 32 wherein measuring at least one parameter of interest includes measuring at least one parameter selected from a group consisting of (i) corrosion, (ii) pressure, (iii) temperature, (iv) fluid flow state, (v) vibration, (vi) chemical composition,(vii) mechanical strain, (viii) chemical contamination, (ix) radioactive contamination, (x) biological contamination, (xi) pipeline inclination, and (xi) seismic events.

36. The method of claim 32 further comprising using a turbine-generator for intercepting a portion of said fluid flow and deriving power therefrom.

37. The method of claim 32, wherein the flow propelled interrogation device comprises:

i. at least one housing;

ii. a plurality of wheel assemblies mounted on said at least one housing, said wheel assemblies extendable to contact an inner wall of said pipeline;

iii. a sail engaged with said housing for intercepting at least a portion of said fluid flow for propelling said interrogation device along said pipeline;

iv. a controller for controlling the motion of said interrogation device and for transmitting signals to and receiving signals from said at least one measurement station; and

v. a power source supplying power to said controller.

38. The method of claim 32, wherein the measurement station receives power from a power source chosen from the group consisting of (i) a commercially packaged battery, (ii) a thick film battery integrally attached to a measurement station, (iii) a piezoelectric power source deriving power from shock and vibration in the proximity of the measurement station, and (iv) a thermoelectric generator integrated into the measurement station.

39. The method of claim 32, wherein the fluid flow is a gas flow.

40. An interrogation device for determining at least one parameter of interest relating to a gas pipeline, comprising:

a. at least one housing;

b. a plurality of wheel assemblies mounted on said at least one housing, said wheel assemblies extendable to contact an inner wall of said pipeline;

c. a sail engaged with said housing for intercepting at least a portion of said fluid flow for propelling said interrogation device along said pipeline;

d. a controller for controlling the motion of said interrogation device and for transmitting at least one first signal to and receiving at least one second signal from at least one measurement station attached to said pipeline; and

e. a power source supplying power to said controller.

41. The interrogation device of claim 40, wherein at least one of said plurality of wheel assemblies includes a brake acting cooperatively with said controller to control the speed of said interrogation device in the pipeline.

42. The interrogation device of claim 40, wherein the at least one housing comprises a plurality of housings pivotally joined together to provide enhanced motion through at least one bend in said pipeline.

43. The interrogation device of claim 40, wherein the sail is adjustable in size.

44. The interrogation device of claim 43, wherein the controller adjusts the size of the sail according to programmed instructions to adjust the speed of the interrogation device in the pipeline.

45. The interrogation device of claim 40 wherein the interrogation device is adapted to send at least one command signal to the at least one measurement station.

46. The interrogation device of claim 40 wherein the interrogation device is adapted to receive at least one data signal from said at least one measurement station

47. The interrogation device according to claim 40, wherein the interrogation device transmits power to said measurement station through radio frequency transmission.

48. The interrogation device of claim 36, wherein the controller comprises :

i. circuits for controlling the brake actuation and the sail size;

ii. a processor and memory for performing predetermined instructions; and

iii. an RF transceiver for transmitting and receiving said first and second signals.

49. The interrogation device of claim 40, wherein the power source comprises a turbine-generator disposed on said housing and adapted to intercept a portion of said fluid flow for deriving power therefrom.

50. The interrogation device of claim 40, wherein the power source comprises at least one battery.

51. A method for determining at least one parameter of interest related to a pipeline having a gas flowing therethrough, comprising:

a. traversing an interrogation device through the pipeline such that said interrogation device is adapted to provide a predetermined pressure disturbance for inducing a predetermined strain in said pipeline;

b. transmitting a first signal from said interrogation device to each of a plurality of measurement stations attached to said pipeline at a plurality of predetermined locations, each of said plurality of measurement stations measuring said at least one parameter of interest in response thereto; and

c. receiving a second signal related to said parameter of interest at said interrogation device transmitted by each of said plurality of measurement stations.

52. The method of claim 51, further comprising generating a relationship between said parameter of interest and said pressure differential at each predetermined location.

53. The method of claim 52, further comprising presenting a graphical presentation of said relationship.

54. The method of claim 51, wherein the interrogation device comprises:

i. at least one housing;

ii. a plurality of wheel assemblies mounted on said at least one housing, said wheel assemblies extendable to contact an inner wall of said pipeline;

iii. a sail engaged with said housing for intercepting at least a portion of said fluid flow for propelling said interrogation device along said pipeline;

iv. a controller for controlling the motion of said interrogation device and for transmitting at least one first signal to and receiving at least one second signal from at least one measurement station attached to said pipeline; and

v. a power source supplying power to said controller.

55. The method of claim 54, wherein at least one of said plurality of wheel assemblies includes a brake acting cooperatively with said controller to control the speed of said interrogation device in the pipeline.

56. The method of claim 54, wherein the at least one housing includes a plurality of housings pivotally joined together to provide enhanced motion through at least one bend in said pipeline.

57. The method of claim 54, wherein the sail is adjustable in size.

58. The method of claim 57, wherein the controller adjusts the size of the sail according to programmed instructions to adjust the speed of the interrogation device in the pipeline.

59. The method of claim 60, wherein said parameter of interest is at least one of (i) axial strain, (ii) hoop strain, and (iii) ultrasonic micro-crack emission.